

## 1.0 ESOH Policies and Processes

ESOH risks will be identified, assessed, and managed throughout the lifecycle of the program. ESOH hazards will be eliminated or mitigated to the lowest level reasonably practicable. When appropriate levels of mitigation have been exhausted, all residual ESOH risks will be forwarded to the appropriate authority level for acceptance. ESOH risk mitigations will be verified through appropriate analysis, testing, demonstration or inspection to ensure that the selected mitigation results in the expected residual ESOH risk. The hazards will be tracked in a Hazard Tracking System (HTS) database for continued assessment, mitigation, and status monitoring.

### 1.1 ESOH Risk Management Process

#### 1.1.1 Hazard identification

Hazards will be identified through a systematic hazard analysis process encompassing detailed analysis of system hardware and software, considering the environment in which the system exists and the intended use or application. This includes hazards caused by individual subsystems integrated into the platform, hazards caused by the interaction between subsystems integrated into the platform, and hazards caused by the interaction of the platform and other platforms/controllers within the BCT.

#### 1.1.2 Risk analysis

PM GCV will use the following risk severity (Table 1-1) and probability (Table 1-2) categories and definitions from MIL-STD-882D for determining ESOH risk levels.

**Table 1-1 Hazard Severity Categories and Definitions**

Category	Level	Definition
Catastrophic	I	Could result in death, permanent total disability, loss exceeding \$1M, or irreversible severe environmental damage that violates law or regulation.
Critical	II	Could result in permanent partial disability, injuries or occupational illness that may result in hospitalization of at least 3 personnel, loss exceeding \$200K but less than \$1M, or reversible environmental damage causing a violation of law or regulation.
Marginal	III	Could result in injury or occupational illness resulting in 1 or more lost work days, loss exceeding \$10K but less than \$200K, or mitigatable environmental damage without violation of law or regulation where restoration activities can be accomplished.
Negligible	IV	Could result in injury or illness not resulting in a lost work day, loss exceeding \$2K but less than \$10K, or minimal environmental damage not violating law or regulation.

**Table 1-2 Hazard Probability Categories and Definitions**

Category	Level	Definition	
		Individual Item	Fleet or Inventory
Frequent	A	Likely to occur often in the life of an item, with a probability of occurrence greater than $1 \times 10^{-1}$ in that life.	Continuously experienced.
Probable	B	Will occur several times in the life of an item, with a probability of occurrence less than $1 \times 10^{-1}$ but greater than $1 \times 10^{-2}$ in that life.	Will occur frequently.
Occasional	C	Likely to occur some time in the life of an item, with a probability of occurrence less than $1 \times 10^{-2}$ but greater than $1 \times 10^{-3}$ in that life.	Will occur several times.
Remote	D	Unlikely but possible to occur in the life of an item, with a probability of occurrence less than $1 \times 10^{-3}$ but greater than $1 \times 10^{-6}$ in that life.	Unlikely, but can reasonably be expected to occur.
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced, with a probability of occurrence less than $1 \times 10^{-6}$ in that life.	Unlikely to occur, but possible.

ESOH risk is categorized by using a Hazard Risk Index matrix (Table 1-3). This assessment allows one to assign qualitative measure to an ESOH hazard based on its severity and its probability of occurrence. This value is then often used to rank different ESOH risks for prioritization purposes. The HRI matrix is also used to determine the level at which any residual ESOH risk must be accepted after design and operational hazard control features have been fully implemented. The risk levels (High, Serious, Medium and Low) are shown in Table 1-3.

**Table 1-3 Risk Matrix**

Hazard Severity	Probability of Occurrence				
	Frequent (A)	Probable (B)	Occasional (C)	Remote (D)	Improbable (E)
Catastrophic (I)	High	High	High	Serious	Medium
Critical (II)	High	High	Serious	Medium	Medium
Marginal (III)	Serious	Serious	Medium	Medium	Medium
Negligible (IV)	Medium	Medium	Low	Low	Low

Hazards, as they are identified will be assigned an initial risk level using the HRI Matrix. This initial risk assignment assumes that no hazard controlling measures have been identified. Those hazards that have a High or Serious initial risk will be given priority for mitigation. Mitigation measures will be developed and implemented as part of the design process. A proposed risk assignment will be assigned to hazards after mitigation measures have been developed for implementation. A final risk assignment is based upon the successful application and verification of the mitigation measures.

### 1.1.3 Risk Mitigation

As stated in DoDI 5000.2, “As part of risk reduction, the PM shall prevent ESOH hazards, where possible, and shall manage ESOH hazards, where they cannot be avoided.”

The following order of precedence shall be used to eliminate/mitigate hazards:

- **Eliminate by Design Selection** – Unacceptable hazards and environment conditions shall be eliminated or their associated risks mitigated by design when feasible.
- **Incorporate Safety Devices** – Hazards or unacceptable environment conditions that cannot be eliminated or controlled through design selection shall be controlled to an acceptable level of risk through the use of fixed, automatic or other protective safety design features or devices. Provisions shall be made for periodic functional checks of safety devices.
- **Provide Warning Devices** – Devices will be installed to detect hazardous or unacceptable environment conditions that cannot be otherwise eliminated or controlled. Adequate warnings shall be provided to alert personnel of the hazard or unacceptable condition and afford sufficient time for personnel response.
- **Develop Procedures and Training** – When all other reasonable possibilities of hazard resolution or environment protection have been exhausted, procedural controls and specialized training may be used to counter hazardous or unacceptable environment conditions and actions. Warning and inspection provisions and procedures will be used to detect and correct failures, malfunctions and errors before the hazard or environment damage manifests itself. Any severity category I or II residual hazard or potential environment impact will be reported to the PM GCV for risk acceptance or the initiation of appropriate action and direction. For any severity category I and II hazards, in no case will a single warning or caution or other form of written advisory be the only form of risk reduction unless specifically approved by the Government.

### 1.1.4 Hazard Tracking

ESOH hazards will be tracked consistent with requirements of the AR 385 Series and MIL-STD-882. ESOH risk tracking and mitigation measures will be documented via regularly scheduled System Safety Working Group (SSWG) meetings and tracked using an ESOH hazard reporting application database referred to as the Hazard Tracking System (HTS). The ESOH HTS application and database will provide the capability to document and manage ESOH hazards, hazardous materials (including prohibited materials) information, and NEPA data. Available historical data including lessons learned from other similar fielded systems will be assessed for applicability during the hazard analyses and risk assessments.

#### 1.1.4.1 ESOH Hazard Application

The ESOH hazard application shall allow for the documentation of identified system hazards. These hazard details include: type, category, the entry of pre and post hazard control implementation, severity and probability risk codes (initial/proposed/final Risk Assessment Code (RAC)), hazard scenarios and causes, control (mitigation plans), the verification information supporting hazard control (mitigation) closure status, and residual risk.

#### 1.1.4.2 Hazardous Materials Application

The Hazardous Materials application shall allow for full tracking and provide the location for hazardous and prohibited materials definition, usage and associated system information. The hazardous and prohibited materials entries will be cross-linked with hazard reports for those cases where these materials are integral to any hazard report and will have connectivity to the NEPA data application.

#### 1.1.4.3 NEPA Data Application

The NEPA data application shall allow for the input of program information to support downstream coordination of system environmental design considerations. These entries will capture relevant environment system design, operation and materials information to enable test site and fielding installations to make knowledgeable budgeting and planning decisions based on platform design.

#### 1.1.5 Hazard Resolution

The ESOH team will monitor and track ESOH risks and recommend mitigation planning until the hazard is closed. Hazard closure categories are identified in Table 1-4.

**Table 1-4 Hazard Closure Categories and Definitions**

	<b>Category</b>	<b>Definition</b>
<b>1.</b>	<b>Closed – Admin:</b>	This terminology refers to entries in the HTS that do not require hazard assessment or hazard acceptance. Rows 1.a. – 1.d. identify the allowed subsets of this category. These HTS entries can be closed out by the system administrator or appropriate WG.
<b>1.a.</b>	<b>Closed – Practice:</b>	This terminology will be used to close out any items that were entered as the result of a practice session.
<b>1.b.</b>	<b>Closed - Duplicate:</b>	This terminology will be used to close out any hazard that was duplicated elsewhere. The associated duplicate hazard will be referenced in the closed-out hazard. Duplicate hazard number should be included in the hazard scenario field.
<b>1.c.</b>	<b>Closed – System/Capability Deferred:</b>	This terminology will be used to close out any hazard that is no longer appropriate based on directed program changes. Rationale is to be included in the hazard scenario field.
<b>1.d.</b>	<b>Closed - Not a Hazard:</b>	This terminology will be used to Close out any HTS entry that is later rejected after appropriate WG review determines it is not credible for any number of reasons (e.g., it is managed in the survivability domain, it is a cause and not a true hazard, it is simply not a hazardous condition, etc). This reason is to be included in the hazard scenario field. Note that if the entry is determined to be a “cause”, it needs to be captured in the appropriate hazard that is documented in the HTS, prior to using this criterion to close the “cause”.

	Category	Definition
2.	<b>Closed – Hazard Eliminated:</b>	This terminology will be used to close out any hazard that has been eliminated by design. Hazard scenario field should include information about design change, if not obvious. These can be closed out by the appropriate WG.
3.	<b>Closed – By Standard:</b>	This terminology will be used to close out any hazard where the WG agrees that the design meets or exceeds all applicable consensus and/or military design standards (or has been verified through specialized, unique military testing, where standards do not exist) and that the environment in which it will operate is consistent with that envisioned by the design standards. Hazard scenario field must include reference to the specific standard (Consensus and or Military), or applicable test data information, that was used. These can be closed out by the appropriate WG.
4.	<b>Closed - Risk Accepted:</b>	This terminology will be used to close out any hazard that has the residual risk formally accepted by the appropriate level of management using the Army Risk Management process. These can be closed out by the appropriate WG once the risk acceptance process is completed.

### 1.1.6 Risk Acceptance

ESOH risks will be entered into the ESOH HTS database and reviewed by the ESOH team for continued assessment, mitigation and status monitoring. ESOH risks will be eliminated or reduced to the lowest risk level practical. The risk that remains after all planned risk management measures have been implemented, are considered residual risk per AR 385 Series and MIL-STD-882. When appropriate levels of mitigation have been exhausted, all residual ESOH risks will be forwarded to the appropriate risk acceptance authority (Table 1-5) for acceptance and closure.

**Table 1-5 Residual Risk Acceptance Authorities**

Residual Risk Level	Acceptance Authority
<b>High</b>	Army Acquisition Executive (AAE)
<b>Serious</b>	Army PEO GCS
<b>Medium</b>	Army PM GCV
<b>Low</b>	Army PM GCV

### 1.2 Safety Critical Function (SCF) Identification Process

ESOH will be linked into the architecture thru the concept of SCFs. This effort ensures that the formal architecture model will both influence ESOH and be influenced by ESOH.

First and foremost, a SCF must meet the below definition:

*A function that, if performed incorrectly or not performed, the most immediate and credible outcome could result in death, serious injury, or loss of the system.*

This implies a link between the function, or failure of the function, and a Category I or Category II hazard.

The following functions have been identified as having potential safety implications. The safety implications are the result of failure to perform, performance in a degraded mode, or performance out of sequence of these functions and where the most credible, immediate outcome results in death, serious injury or system loss. These identified functions will be used to guide the safety analysis process. During the analysis process, these functions will be traced through the systems and between systems to identify any associated hazards so that they can be mitigated.

- Any function that controls or directly influences the pre-arming, arming, enabling, release, launch, firing, or detonation of a weapon system, including target identification, selection, and designation.
- Any function that determines, controls, or directly influences the flight or ground path of a weapon or robotic system.
- Any function that controls or directly influences the movement of gun mounts, launchers, and other equipment, especially with respect to the pointing and firing safety of that equipment.
- Any function that controls or directly influences the movement of munitions and/or hazardous materials (HAZMAT).
- Any function that monitors the state of the system for purposes of ensuring its safety.
- Any function that senses hazards and/or displays information concerning the protection of the system.
- Any function that controls or regulates hazardous energy sources in the system.

NOTE: Just because a function meets one of the criteria put forward in these bullets does not make it a SCF. It must first meet the conditions for SCF described in the definition.

### 1.3 Prohibited Materials Management Process

DoDI 5000.2 states that, “during system design, the PM shall document hazardous materials used in the system and plan for the system’s demilitarization and disposal.” As part of the overall risk reduction strategy, GCV IFV program will work to reduce the use of hazardous and prohibited materials.

Specific materials are prohibited for use on the programs because these materials represent the potential for significant increases in program life-cycle cost. The list of prohibited materials is provided below in Table 1-2. The use of any prohibited materials listed in Table 1-2

Table 1-2 within the deliverable item and/or in operation/support of the item requires the contractor to report the use of these materials. The contractor shall not construe the reporting of prohibited material as the authority to use that material in their product and the usage of that material will remain a noncompliance until formal Government exception is granted. In addition, Class I and II Ozone Depleting Chemicals (ODC) **are banned** on the program.

A time-limited waiver to use a prohibited material may be requested through a Prohibited Materials Usage Approval Request (PMUAR) from PM GCV for a product/material until a suitable alternate material is developed. Efforts to find alternate materials will be documented in the Hazardous Materials Management Program Report submittals.

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Note: Receiving an exception for use of a prohibited material does not relieve the contractor of full compliance with laws, statutes, and regulations governing the use of the approved material nor from controlling the inherent hazard risk associated with such materials.

**Table 1-2 Prohibited Materials**

Asbestos	Tetrachloroethylene
Beryllium, Alloys and Compounds	Trichloroethylene
Cadmium	Polychlorinated Biphenyls (PCB)
Hexavalent Chromium	Radioactive Material
Mercury	Methyl Ethyl Ketone
Lead and Compounds	

The following are not prohibited and record keeping/reporting of prohibited (and hazardous) materials is not required:

- Materials in equipment developed by the contractor or its subcontractors that are to be held at a contractor facility and the contractor have the responsibility for disposal of the equipment. Disposal is defined as the process of reutilizing, transferring, donating, selling, destroying, or other ultimate disposition of property (Defense Materiel Disposition Manual 4160.21-M).
- Materials containing less than 0.1% of the prohibited material by weight. The weight basis is determined as a percent by weight of each prohibited material in the individual surface treatment or individual homogeneous material. (For example, a hexavalent chromium conversion coated, cadmium plated, low alloy steel hinge would require an exception for both the hexavalent chromium and the cadmium regardless of how much the hinge weighs. The weight basis is based on how much hexavalent chromium is in the conversion coating and how much cadmium is in the plating.) The Material Safety Data Sheet (MSDS) may be used as the basis of the hazardous chemical content of the material. These thresholds apply to all materials regardless whether a MSDS exists or not.
- Materials in production equipment that will not be delivered to the government.
- Materials in brassboards used for testing. A brassboard is an experimental device (or group of devices) used to determine functional feasibility and to assess technical and operational capability. It normally will be a model using off-the-shelf equipment that's modified to demonstrate the technical and operational proof of principles of immediate interest. It may resemble the end item, but is not intended for use as the end item.

The following are not prohibited but record keeping/reporting of government supplied hazardous and prohibited materials information is required:

- Materials contained in government furnished equipment (GFE). GFE hazardous material information will be provided to the contractor by the Government.
- Materials in surrogate hardware for use testing; and any other hardware deemed surrogate. (Surrogate hardware is an interim substitute part or equipment used on (or in conjunction

with) a prototype or test equipment as a temporary substitute whose use is necessary to meet cost and/or schedule constraints. If a surrogate part becomes incorporated in the final design, an exception must be obtained.) Contractors shall make every reasonable effort to identify and report hazardous material in surrogate hardware.

- Materials as identified in paragraph 1.3.1 of the COTS Assembly Process.

If a military battery purchased by the vendor contains prohibited materials, then an exception is required unless the hardware meets one of the exemptions listed above.

### **1.3.1 COTS Assembly Process**

The contractor will follow this process to obtain and review prohibited material information for COTS assemblies. In cases where the supplier will not or cannot identify if a COTS assembly contains prohibited materials or was manufactured with an ODC to meet requirements, then the following process will be used. The following process only applies to COTS assemblies.

- Determine if an alternate COTS vendor is available.
- Use an alternate vendor that can supply prohibited material information provided that the alternate vendor's product is comparable in cost, performance, and quality.
- If an alternate vendor is not available, determine if the COTS supplier has prohibited and/or ODC material information. If the information is available, collect the information and report it in the Hazardous Materials Management Program Report which shall include identification of the source of the information.
- If a prohibited material is identified, an exception shall be submitted regardless of the source of the information.

Note: When it cannot be determined if COTS contains prohibited materials, the annual Hazardous Materials Management Program Report submissions shall document the contractor's efforts to identify prohibited materials contained in COTS and all efforts to procure compliant items and shall track COTS in a method similar to components containing prohibited material.

- The use of Class I and/or II ODC are prohibited over the lifecycle of hardware (including design, production, operation, maintenance, and disposal). When it cannot be determined if COTS used ODC over the lifecycle of the hardware, the contractor shall provide a statement in the Hazardous Materials Management Program Report advising of the unavailable information.

The contractors are required to evaluate and manage their sub tier suppliers' performance in the areas of hazardous and prohibited material identification and minimization/elimination and will include the results of their sub tier suppliers' activities in the Hazardous Materials Management Program Report. Any hazardous and prohibited materials that must be used due to a lack of acceptable alternatives will be documented and tracked in the HTS database.

### **1.4 Hazardous Materials Management Process**

DoDI 5000.2 states that, "during system design, the PM shall document hazardous materials used in the system and plan for the system's demilitarization and disposal." Hazardous/toxic materials are defined by the Title 40 CFR Subchapter C (Air Program) Parts 50-99, Subchapter D (Water Program) Parts 100-149, Subchapter I (Solid Waste) Parts 239-299, Subchapter J (Superfund,



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Emergency Planning, and Community Right-to-Know Programs) and Subchapter R (Toxic Substance Control Act).

As part of the overall GCV PM risks reduction strategy, the contractors along with their suppliers will incorporate GCV design such that the user can train, operate, maintain and dispose the system in full compliance with the U.S., foreign, and international environmental quality policies, statutes, laws and regulations.

### **1.5 NEPA Compliance**

The program will comply with the NEPA and must ensure NEPA analyses are conducted and documentation completed as required by Title 32, CFR Part 651: Environmental Analysis of Army Actions; Final Rule.

### **1.6 Test and Evaluation**

For the GCV program, in accordance with DoDI 5000.2, E5.4.5, “Test and Evaluation (T&E) Planning shall consider the potential testing impacts on the environment (42 U.S.C. 4321-4370d and EO 12114).”

The contractor is responsible for providing environment and safety documentation, such as NEPA data and safety analyses and assessments, to PM GCV for coordination and processing. Test plans generated to support specific events or evaluations should be coordinated with the recipient (i.e., Center for Health Promotion and Preventive Medicine (CHPPM)) of the data prior to data collection to ensure the data generated is appropriate and usable. The ESOH team will review and coordinate the environment and safety documentation with test installations in support of product test.

### **1.7 Progress Reporting**

ESOH progress reporting will be accomplished to identify ESOH activities and issues throughout the course of the program, most notably at working group meetings, technical interchange meetings and program reviews.